Quality Assurance

1. SCOPE OF TESTING 408
2. TYPES OF XRF-SPECTROMETERS 409
3. X-RAY FLUORESCENCE SPECTROMETERS LOW COST EQUIPMENT (200 W) 409
4. ANALYTICAL TRENDS IN XRF 410
5. ADDITIONAL METHODS 410
6. ADDITIONAL ANALYTICAL EQUIPMENT 410
7. ADDITIONAL ANALYTICAL EQUIPMENT 410

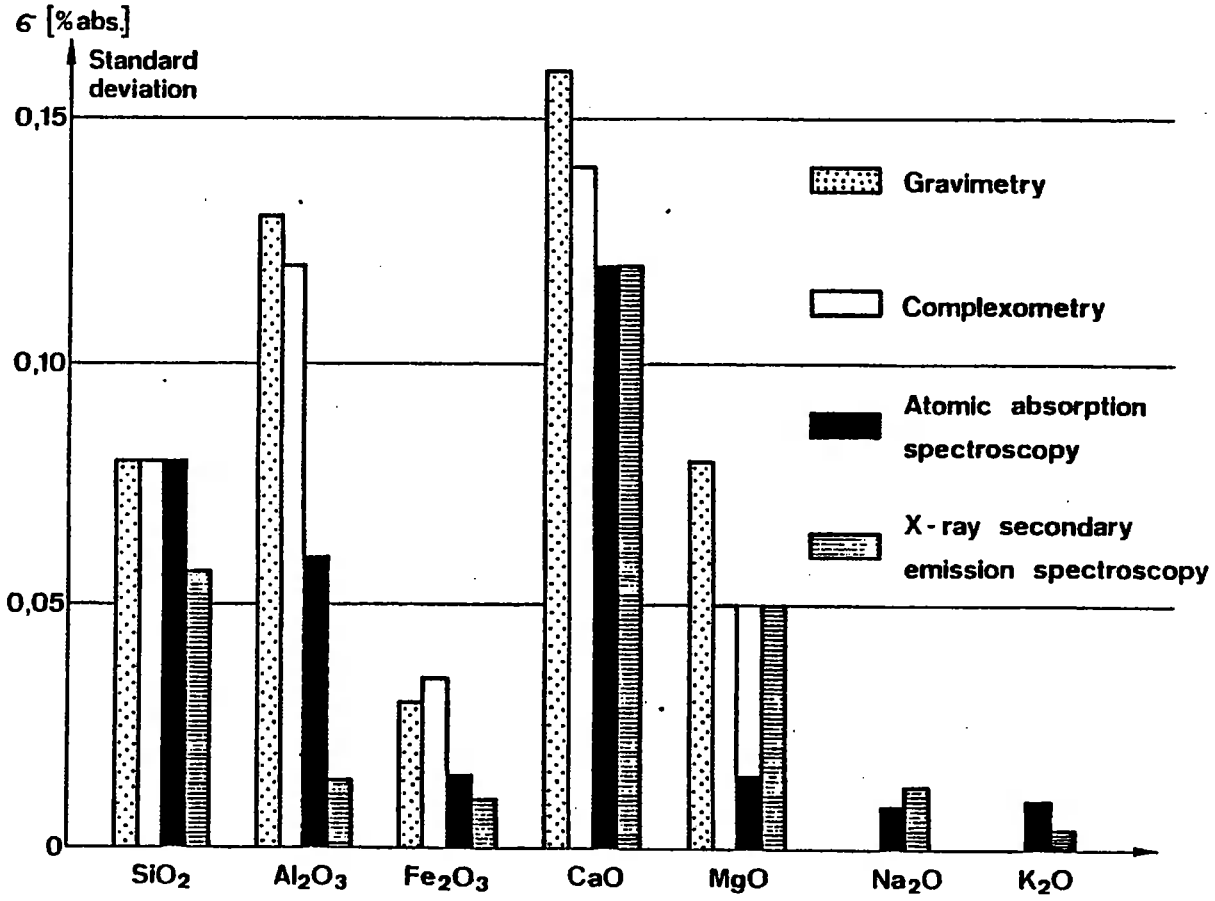
1. SCOPE OF TESTING

- Production control
- Quality Control (due to standard specifications)
- Material technological investigations
  - project planning
  - application
  - research & development

METHODS OF CHEMICAL CONTROL

	Criteria			
Method	Investment	Information	Times of analysis	Personnel
Titration	Very little	Σ Of carbonates	Minutes	Few, trained
Gravimetry volumetry	Little	Main elements LS, SR, AR; BOGUE	Many hours	Several, trained
Complexo metry colorimetry	~ $10'000	CaO, Al_2O_3, Fe_2O_3, MgO	Approx. 2 - 3 Hrs.	Several, trained
AAS	~ $30'000	All elements except S, Cl, F, P	Approx. 2 - 3 Hrs.	Several + specialist
XRF	~$250' 000	All elements + complete automation (off or online)	Minutes	Few + specialist

Fig. 1 **Standard deviations for clinker analyses by different analytical techniques.**



2. TYPES OF XRF-SPECTROMETERS

- Wavelength dispersive (WLD)
  - Sequential Mode
  - Simultaneous ('Mull) Channel') mode
- Energy dispersive (ED)
- Low cost (200 W) WLD Systems
- Bench-top XRF analysers
- Continuous ('on-line') XRF analysers

3. X-RAY FLUORESCENCE SPECTROMETERS LOW COST EQUIPMENT (200 W)

- ADVANTAGES:
  - Moderate purchase costs
  - Lower operational cost
  - Simple operation and maintenance

- DISADVANTAGES:
  - Less sensitive
  - Increased! measuring time
  - Frequent re-calibration
  - No trace element analyses

4. ANALYTICAL TRENDS IN XRF

- Trace element analyses
- Chemical analysis of liquids
- Analysis of carbon
- Sulphide/sulphate analysis

5. ADDITIONAL METHODS

- Sulphur analyser
- Carbon analyser
- Coal analyser
  - calorimeter
  - proximate analysis
- Free lime
  - Conductometric
  - X-ray diffraction

6. ADDITIONAL ANALYTICAL EQUIPMENT

- delivery control of waste
- emission control
- XRF (additional channels or sequential mode)
  or
  AAS → trace elements in liquids/solids
- Ion chromatography or ion-sensitive electrodes
  - halogens (chlorine, fluorine, bromine)
- flash point determination
- viscometer
- gas chromatography
  - organic compounds (PCB's etc.) bomb calorimeter (automatic)

7. ADDITIONAL ANALYTICAL EQUIPMENT

- gas chromatography with mass spectrometer
  - emission control on stack gas (organic compounds, volatile toxic elements etc.)